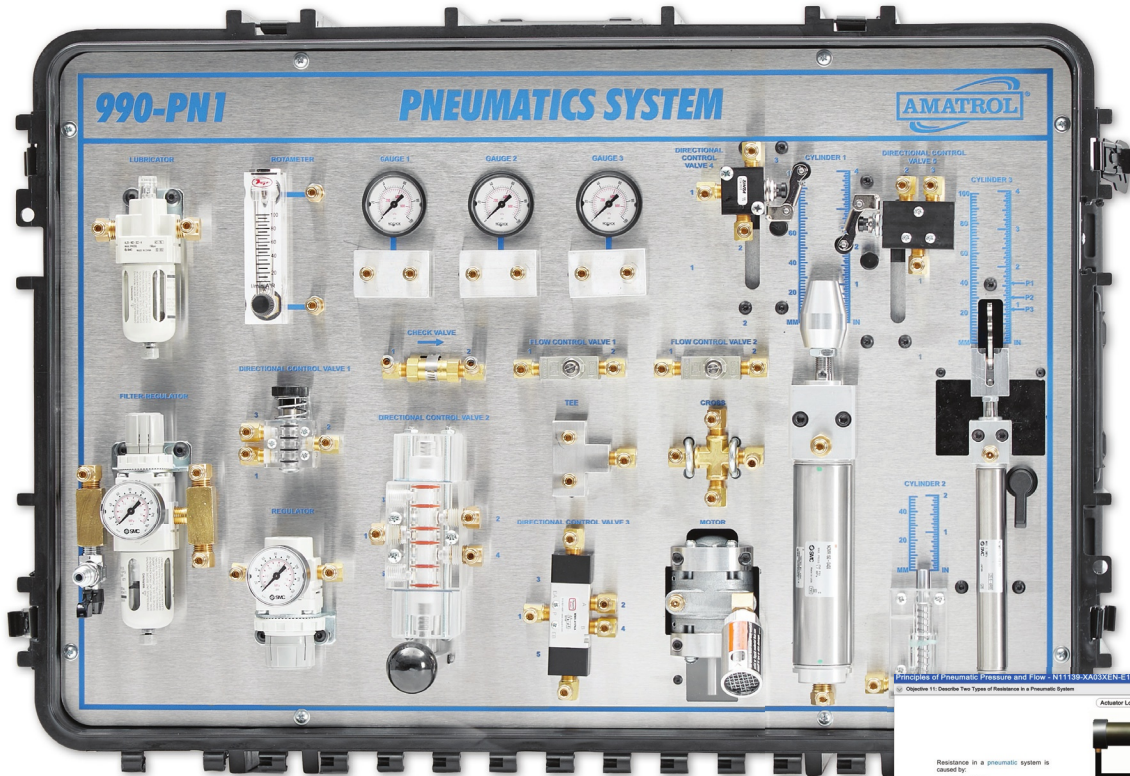


Portable Pneumatics Learning System

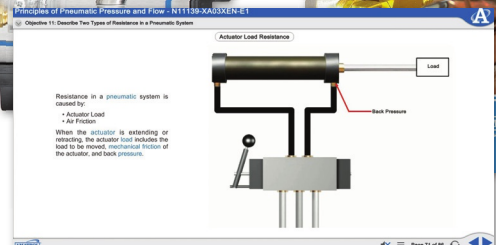
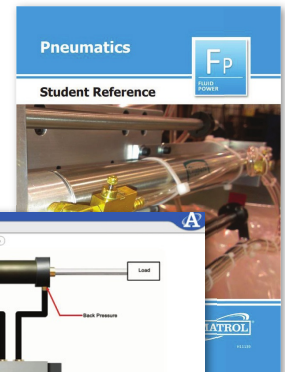
990-PN1

Fp

FLUID
POWER



990-PN1



Interactive Multimedia Curriculum and Student Reference Guide

Learning Topics:

- Pneumatic Power Systems
- Pneumatic Circuits
- Pressure and Flow
- Speed Control Circuits
- Directional Control Valves
- Air Logic
- Pneumatic Maintenance
- Schematics
- Air Flow and Resistance
- Flow Control Valves
- Cam Valves

Amatrol's Portable Pneumatics Learning System (990-PN1) teaches basic and intermediate pneumatic concepts. Pneumatic power is a foundation of industry used in many applications across a wide variety of fields, such as agriculture, pharmaceuticals, and automation. Learners will gain critical hands-on experience operating pneumatic cylinders, flow controls, directional control valves, air motors, and pressure gauges. This system requires a compressed air supply, a Hand Tool Package (41221), and a computer.

This portable, highly-durable pneumatic circuit design training system features real-world pneumatic components, including a rotameter, pressure gauges, flow control valves, directional control valves, and much more! Users will learn to use pneumatic hoses included with the system to create working pneumatic circuits from schematics and practice skills, such as connecting and reading a flowmeter and operating a cam-operated sequence circuit. Amatrol's commitment to quality and detail ensures that learners will work with components they'll actually use on the job.



Technical Data

Complete technical specifications available upon request.

Portable case
Rotameter
Pressure Gauges, 0-1000 PSI (3)
Lubricator
Pressure Regulator, Non-Relieving
Filter/Regulator, Manifold
Check Valve
Tee
Cross
Flow Control Valves (2)
Air Motor
Directional Control Valve, Lever
Directional Control Valve, Pilot
Directional Control Valve, Push Button
Directional Control Valve, 3/2 Cam
Directional Control Valve, 5/2 Cam
Large Double-Acting Cylinder, 1 1/2" bore
Small Double-Acting Cylinder, 3/4" bore
Single-Acting Cylinder

Loose Components Kit

Micronic Filter Patch
Impingement Device
Syringe, 10cc
Filter Element, 5 micron
Filter Element, 20 micron
Filter Element, 70 micron
Lever Arm Link Assembly

Hose Kit

6" Hose Assembly
12" Hose Assembly
18" Hose Assembly
24" Hose Assembly
12" Hose with one quick connect

Multimedia Curriculum (M11139)

Virtual Trainer (NB780)

Instructor's Guide (C11139)

Install Guide (D11139)

Student Reference Guide (H11139)

Additional Requirements:

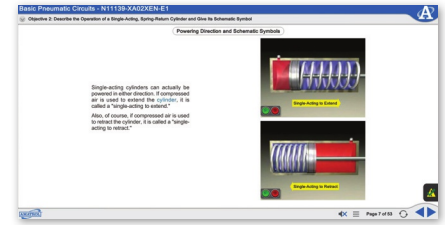
Compressed Air Supply (2 CFM @ 100 PSIG)
Hand Tool Package (41221)
Computer (visit www.amatrol.com/support/computer-requirements for details.)

Utilities:

Electricity: 120VAC/60Hz/1 phase

Study Pneumatic Components and Practice on Real-World Equipment

Amatrol's Portable Pneumatics Learning System packs a full array of basic and intermediate pneumatic theory and skills into a powerful mobile workstation. Major topic areas include various pneumatic and speed control circuits, directional control valves, air flow and resistance, and flow control and cam valves. Learners will study, for example, the applications, schematic symbol, and operation of a 3/2 pneumatic directional control valve (DCV). They will then implement this knowledge by practicing the hands-on skill of using a 3/2 manually-operated DCV to operate a single-acting pneumatic cylinder.



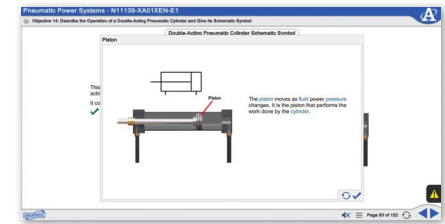
Interactive Multimedia Curriculum

Learn Pneumatic Circuit Design Maintenance Skills

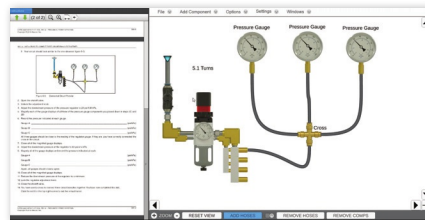
Because air is filled with contaminants, like dirt, pollen, and water vapor, pneumatic equipment may experience rusted pipes, worn parts, and broken seals if not properly and carefully maintained. On the 990-PN1, learners will study common sources of contamination, how the dew point and humidity can affect pneumatic equipment, and why eliminating air leaks is critical. They will also gain hands-on experience with skills like selecting and changing air filters, connecting and adjusting a lubricator, and calibrating gauges.

Engaging, Highly-Interactive Multimedia

Amatrol's curriculum features a highly-interactive, multimedia format that includes stunning 3D graphics and videos, voiceovers of all text, and interactive quizzes and exercises designed to appeal to learners with different learning styles. The 990-PN1's curriculum teaches learners a variety of basic and intermediate pneumatics concepts. For example, learners will study a variety of different types of speed control circuits and gain experience connecting and operating meter-out flow control circuits, as well as exhaust port, pressure port, and independent speed control circuits. The combination of theoretical knowledge and hands-on skills solidifies understanding and creates a strong basis for pursuing more advanced skills.



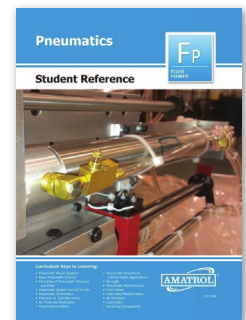
Virtual Trainer for Online Pneumatics Skill-Building



The Portable Pneumatics Training System also features a virtual multimedia trainer! Amatrol's virtual trainers replicate hands-on equipment in such great detail that learners will feel like they are using the actual equipment. Learners will perform essentially the same tasks using virtual trainers that they would perform using equipment hardware. Transition from theory to hands-on is a seamless process.

Student Reference Guide

A sample copy of the Pneumatics Student Reference Guide is also included with the system for your evaluation. Sourced from the system's curriculum, the Student Reference Guide takes the entire series' technical content contained in the learning objectives and combines them into one perfectly-bound book. Student Reference Guides supplement this course by providing a condensed, inexpensive reference tool that learners will find invaluable once they finish their training, making it the perfect course takeaway.



PORTABLE PNEUMATICS LEARNING SYSTEM

This learning system is designed to teach basic and intermediate pneumatics operations, skills, and applications. It shall include a mobile carrying case, pneumatics panel, loose components kit, hose kit, student curriculum and teacher's assessment guide. The minimum requirements include:

Workstation

- (1) Mobile Carrying Case: 29 ½" W x 20 ½" H x 12" D
- (1) Workstation Mounting Panel

Pneumatic Assembly

- (3)-Pressure Gauges, 0-160 PSIG range, 2 1/2"
- (1)-Rotameter
- (1)-Filter/Regulator
- (1)-Pressure Regulator, Non-Relieving
- (1)-Directional Control Valve, Lever-operated
- (1)-Large Cylinder, double-acting, 1 1/2" bore
- (1)-Small Cylinder, double-acting, ¾" bore
- (1)-Cylinder, single-acting
- (1)-Air Motor
- (2)-Flow Control Valves
- (1)-Fitting Tee
- (1)-Fitting Cross
- (1)-Directional Control Valve, Pilot-operated
- (1)-Directional Control Valves, 5/2 cam
- (1)-Directional Control Valve, 3/2 cam
- (1)-Directional Control Valve, Pushbutton-operated
- (1)-Check Valve
- (1)-Lubricator

Loose Components Kit

- (1)-Micronic Filter Patch
- (1)-Impingement Device
- (1)-Syringe, 10cc
- (1)-Filter Element, 5 micron
- (1)-Filter Element, 20 micron
- (1)-Filter Element, 70 micron
- (1)-Lever Arm Link Assembly

Hose Kit

- (1)-6" Hose Assembly
- (1)-12" Hose Assembly
- (1)-18" Hose Assembly
- (1)-24" Hose Assembly
- (1)-12" Hose with one quick connect

Student Curriculum

The student curriculum shall consist of 7 multimedia learning modules covering no less than 46 skills in basic and intermediate pneumatic systems. The topics covered shall include pneumatic power systems, basic pneumatic circuits, principles of pneumatics, basic pneumatic circuits, principles of pneumatic pressure and flow, pneumatic speed control circuits, pneumatic directional control valve applications, air logic, and pneumatic maintenance. The student curriculum shall be designed in a skill-based format that focuses on teaching industry- relevant tasks. The objectives shall be accomplished by organizing the learning material into a series of learning modules, which are further subdivided into three or more segments per module. All learning material needed shall be contained in the packets including text material, laboratory equipment activities, and multimedia directions. No external text sources shall be

required. The specific cognitive skills taught by each text passage shall be identified next to the passage. Each lab activity shall be identified by the industrial task taught. All activities shall be highly detailed with step-by-step instructions to facilitate a self-directed learning environment. A combination of step-by-step enabling activities and creative, problem-solving activities shall be provided. A self-review of five to ten questions shall be provided after each segment. The curriculum must be capable of both self-directed and instructor directed study. All activities must correlate directly to the hardware supplied, with detailed illustrations and diagrams.

In addition to multimedia curriculum, this learning system includes access to Virtual Trainer skill-building. The curriculum shall include four (4) interactive multimedia modules with at least thirty (30) pneumatics industry skills. Major topics include: pneumatic power systems, basic pneumatic circuits, principles of pneumatic pressure and flow, and pneumatic speed control circuits. This software shall be provided as a one seat license or in multiples as required.

Teacher's Assessment/ Portfolio Guides

A teacher's guide shall be provided. It shall contain student data sheets, data sheet solutions, self review answers, quizzes, quiz answers, student skill record sheets, and authentic assessment. A quiz shall be provided for each packet. A question shall be provided in each quiz for each cognitive objective taught. All tasks listed in the packet shall be listed on personalized student record sheets. The Instructor's Package shall include directions for authentic skill assessment.

Certification Alignment

The 990-PN1 aligns with the SACA C-209 Pneumatics Systems 1 credential.

Amatrol Model No. 990-PN1 or equal

990-PN1
PORTABLE PNEUMATIC LEARNING SYSTEM

MODULE 1 PNEUMATIC POWER SYSTEMS

SEGMENT 1	INTRODUCTION TO PNEUMATICS
OBJECTIVE 1	Define pneumatics and give an application
OBJECTIVE 2	Describe the functions of basic components of a pneumatic system
ACTIVITY 1	Pneumatic trainer
OBJECTIVE 3	Define pneumatic pressure and give its units of measurement
OBJECTIVE 4	Describe how to read a pneumatic pressure gauge
SKILL 1	Read a pneumatic pressure gauge
OBJECTIVE 5	Describe the function of a pneumatic schematic
SEGMENT 2	PNEUMATIC POWER
OBJECTIVE 6	Explain six pneumatic safety rules
OBJECTIVE 7	Describe the function of a pressure regulator valve and give an application
OBJECTIVE 8	Describe the operation of a pressure regulator and give its schematic symbol
SKILL 2	Connect and adjust a pressure regulator
OBJECTIVE 9	Describe the function of an air filter
OBJECTIVE 10	Describe the operation of an air filter and give its schematic symbol
SKILL 3	Drain a pneumatic filter
SEGMENT 3	CIRCUIT CONNECTIONS
OBJECTIVE 11	Describe the function of a pneumatic quick-connect fitting and give its schematic symbol
SKILL 4	Connect a pneumatic hose that uses quick-connect fittings
OBJECTIVE 12	Describe the function of a tee and a cross and give their schematic symbols
SKILL 5	Use a tee to connect two circuit branches together
SKILL 6	Use a cross to connect three circuit branches together
SEGMENT 4	BASIC CYLINDER CIRCUITS
OBJECTIVE 13	Describe the function of a pneumatic cylinder and give an application
OBJECTIVE 14	Describe the operation of a double-acting pneumatic cylinder and give its schematic symbol
ACTIVITY 2	Basic operation of a double-acting cylinder
OBJECTIVE 15	Describe the function of a 4-way, 3-position pneumatic DCV and give an application
OBJECTIVE 16	Describe the operation of a 4-way, 3-position pneumatic DCV and give its schematic symbol
OBJECTIVE 17	Describe How DCVs Are Classified
OBJECTIVE 18	Describe the Function of a DCV Schematic
SKILL 7	Connect and operate a double-acting pneumatic cylinder using a 3-position, manually-operated DCV
SKILL 8	Design a multiple cylinder pneumatic circuit

MODULE 2 BASIC PNEUMATIC CIRCUITS

SEGMENT 1	SINGLE-ACTING CYLINDER CIRCUITS
OBJECTIVE 1	Describe the function of a single-acting pneumatic cylinder and give an application
OBJECTIVE 2	Describe the operation of a single-acting, spring-return cylinder and give

ACTIVITY 1	its schematic symbol
OBJECTIVE 3	Basic operation of a single-acting, spring-return cylinder
OBJECTIVE 4	Describe the function of a 3/2 pneumatic DCV and give an application
	Describe the operation of a 3/2 pneumatic DCV and give its schematic symbol
SKILL 1	Connect and operate a single-acting pneumatic cylinder using a 3/2 manually operated DCV
SEGMENT 2	BASIC MOTOR CIRCUITS
OBJECTIVE 5	Describe the function of a pneumatic motor and give an application
OBJECTIVE 6	Describe the operation of a pneumatic motor and give its schematic symbol
SKILL 2	Connect and operate a unidirectional pneumatic motor using a 3-way, manually-operated DCV
OBJECTIVE 7	Describe the function of a muffler and give its schematic symbol
ACTIVITY 2	Air muffler operation
OBJECTIVE 8	List three common pneumatic motor designs and explain where they are used
SEGMENT 3	PNEUMATIC SCHEMATICS
OBJECTIVE 9	Describe the line symbols used with fluid power circuits
SKILL 3	Identify pneumatic symbols
OBJECTIVE 10	Describe seven basic rules for drawing pneumatic schematics
SKILL 4	Draw a pneumatic schematic from the actual circuit connections on the machine
SKILL 5	Connect a pneumatic circuit given a schematic
SKILL 6	Design a multiple actuator pneumatic circuit

MODULE 3 PRINCIPLES OF PNEUMATIC PRESSURE AND FLOW

SEGMENT 1	PRESSURE VS. CYLINDER FORCE
OBJECTIVE 1	Describe how to calculate the force output of an extending cylinder
SKILL 1	Calculate the extension force of a cylinder given its size and pressure
SKILL 2	Measure the force output of an extending cylinder
OBJECTIVE 2	Describe how to calculate the force output of a cylinder in retraction (pull)
SKILL 3	Calculate the retraction force of a cylinder given its size and pressure
OBJECTIVE 3	Describe the two types of pneumatic cylinder loads
OBJECTIVE 4	Describe four forces that act against cylinder movement
SKILL 4	Determine the effect of different loads on cylinder operation
SEGMENT 2	PNEUMATIC LEVERAGE
OBJECTIVE 5	State Pascal's Law and explain its significance in pneumatics
ACTIVITY 1	Verification of Pascal's Law
OBJECTIVE 6	Explain how force is multiplied using Pascal's Law
ACTIVITY 2	Demonstrate how distance is sacrificed to obtain force multiplication
SEGMENT 3	PRESSURE AND VOLUME
OBJECTIVE 7	Describe two methods of representing pressure
SKILL 5	Convert between gauge and absolute pressures
OBJECTIVE 8	Explain how air pressure is created in a pneumatic system
OBJECTIVE 9	State Boyle's Law and explain its significance
SKILL 6	Use Boyle's Law to calculate changes in pressure and volume
ACTIVITY 3	Verification of Boyle's Law
SEGMENT 4	AIR FLOW AND RESISTANCE

OBJECTIVE 10	Explain how a pneumatic system creates air flow
OBJECTIVE 11	Describe two types of resistance in a pneumatic system
OBJECTIVE 12	Explain how Delta P describes pneumatic resistance and explain its importance
SKILL 7	Measure Delta P across pneumatic components
OBJECTIVE 13	Describe what determines the speed of a pneumatic actuator
ACTIVITY 4	Effect of pressure on pneumatic actuator speed

MODULE 4 PNEUMATIC SPEED CONTROL CIRCUITS

SEGMENT 1	AIR FLOW CONTROL AND MEASUREMENT
OBJECTIVE 1	Describe the main function of a pneumatic needle valve and give an application
OBJECTIVE 2	Describe the operation of a needle valve and give its schematic symbol
SKILL 1	Connect and operate a needle valve to control actuator speed
OBJECTIVE 3	Define air flow rate and give its units of measurement
SKILL 2	Convert air volumes at pressures to free air volumes
OBJECTIVE 4	Describe the function of a flowmeter and give an application
OBJECTIVE 5	Describe the operation of a rotameter and give its schematic symbol
SKILL 3	Connect and read a flowmeter
SEGMENT 2	FLOW CONTROL VALVES
OBJECTIVE 6	Describe the function of a pneumatic check valve and give an application
OBJECTIVE 7	Describe the operation of two types of pneumatic check valves and give their schematic symbol
SKILL 4	Connect and operate a check valve
OBJECTIVE 8	Describe the function of the flow control valve and give an application
OBJECTIVE 9	Describe the operation of a flow control valve and give its schematic symbol
SKILL 5	Connect and adjust a flow control valve to control speed of an actuator
OBJECTIVE 10	Describe the effect of actuator load changes on flow control operation
ACTIVITY 1	Effect of actuator load changes on flow control valve operation
SEGMENT 3	SPEED CONTROL
OBJECTIVE 11	Describe the operation of a meter-in flow control circuit and give an application
SKILL 6	Connect and operate a meter-in flow control circuit
OBJECTIVE 12	Describe the operation of a meter-out flow control circuit and give an application
SKILL 7	Connect and operate a meter-out flow control circuit
OBJECTIVE 13	Describe the operation of an exhaust port speed control and give an application
SKILL 8	Connect and operate an exhaust port speed control circuit
OBJECTIVE 14	Describe the operation of a pressure port speed control and give an application
SKILL 9	Connect and operate a pressure port speed control circuit
SKILL 10	Design speed control circuits
OBJECTIVE 15	Define independent speed control and give an application
SKILL 11	Design an independent speed control circuit

MODULE 5 PNEUMATIC DCV APPLICATIONS

SEGMENT 1	CAM VALVES
OBJECTIVE 1	Describe the function of a pneumatic cam-operated valve and give an application
OBJECTIVE 2	Describe the operation of a pneumatic cam-operated DCV and give its schematic symbol
SKILL 1	Connect and operate a pneumatic cam-operated 4/2 DCV
SKILL 2	Connect and operate a pneumatic cam-operated 3/2 DCV
SEGMENT 2	CAM VALVE APPLICATIONS
OBJECTIVE 3	Describe the operation of a 2-speed pneumatic circuit using a cam valve
SKILL 3	Design a rapid traverse-slow feed pneumatic circuit
SKILL 4	Design a pneumatic circuit to sequence two cylinders
OBJECTIVE 4	Describe three methods of decelerating a pneumatic cylinder
SKILL 5	Connect and operate a cylinder deceleration circuit using power braking
SEGMENT 3	TWO-WAY VALVES
OBJECTIVE 5	Describe the function of two-way valves
OBJECTIVE 6	Describe the construction and operation of five types of two-way valves
SKILL 6	Connect and operate a two-way valve

MODULE 6 AIR LOGIC

SEGMENT 1	EXTERNALLY PILOTED VALVES
OBJECTIVE 1	Describe the function of an externally air-piloted DCV and give an application
OBJECTIVE 2	Describe the function of a detent and give its schematic symbol
OBJECTIVE 3	Describe four types of pneumatic DCV construction
OBJECTIVE 4	Describe the operation of an externally air-piloted DCV and give its schematic symbol
SKILL 1	Design a pneumatic circuit that uses an externally air-piloted DCV
SEGMENT 2	INTRODUCTION TO AIR LOGIC
OBJECTIVE 5	Define air logic and give two applications
OBJECTIVE 6	List four advantages and four disadvantages of air logic
OBJECTIVE 7	Describe the operation of an air logic cylinder sequence circuit
SKILL 2	Connect and operate a cam-operated sequence circuit
SEGMENT 3	AIR LOGIC DESIGN
OBJECTIVE 8	Describe the function of a shuttle valve and give an application
OBJECTIVE 9	Describe the operation of a shuttle valve and give its schematic symbol
OBJECTIVE 10	Describe the operation of a pneumatic seal-in circuit
SKILL 3	Connect and operate an air logic circuit to control a reciprocating cylinder

MODULE 7 PNEUMATIC MAINTENANCE

SEGMENT 1	AIR FILTRATION
OBJECTIVE 1	List four sources of compressed air contamination and explain their effect
OBJECTIVE 2	Describe the operation of three common filter elements
OBJECTIVE 3	Describe the function of a coalescing filter and give an application
OBJECTIVE 4	Describe the operation of a coalescing filter and give its schematic symbol
SKILL 1	Change an air filter element
OBJECTIVE 5	Explain how air filter elements are rated
ACTIVITY 1	Measurement of filter element flow rate and pressure drop
OBJECTIVE 6	Describe how to select a filter for an application

SKILL 2

Select an air filter for an application

SEGMENT 2

WATER REMOVAL

OBJECTIVE 7

Define dew point and relative humidity and explain their importance

OBJECTIVE 8

Explain how water condenses in a pneumatic system and its effect

ACTIVITY 2

Air filter removal of free water

OBJECTIVE 9

Describe two methods of removing water vapor from a pneumatic system

OBJECTIVE 10

Describe the function of an aftercooler and give an application

OBJECTIVE 11

Describe the function of a dryer and give an application

OBJECTIVE 12

Describe the principle of operation of three types of dryers and give an advantage of each

OBJECTIVE 13

Describe the operation of a refrigeration type air dryer

ACTIVITY 3

Effect of cooling below dew point

OBJECTIVE 14

Describe the function of pneumatic system trap

OBJECTIVE 15

Describe the operation of two types of pneumatic traps and give the schematic symbol of each

SEGMENT 3

LUBRICATION

OBJECTIVE 16

Describe the function of air lubrication and list three lubrication methods

OBJECTIVE 17

Describe the function of a lubricator and give its schematic symbol

OBJECTIVE 18

Describe the operation of three types of pneumatic lubricators and give an application of each

OBJECTIVE 19

Describe the types of oils used in lubricators

SKILL 3

Connect, fill and adjust a lubricator

SEGMENT 4

SERVICING PNEUMATIC COMPONENTS

OBJECTIVE 20

Describe how pressure gauges are calibrated

OBJECTIVE 21

Describe how acrylic flowmeters are cleaned

OBJECTIVE 22

Describe the importance of eliminating air leaks

OBJECTIVE 23

Describe how to locate air leaks

OBJECTIVE 24

Describe four common pneumatic component failures and their probable causes